

I hereby certify that this correspondence is being deposited with the United States Postal Service as Express Mail in an envelope addressed to:

ASSISTANT COMMISSIONER OF PATENTS
WASHINGTON, DC 20231

bearing Label Number EE 651 410 479 US and mailed December 6, 1999

MIRIAM DAVIS

Print Name

Miriam Davis

Signature

PATENTS

Inventors: Richard Alan Dayan
Eric Richard Kern

METHOD AND SYSTEM FOR SECURING A PERSONAL COMPUTER BUS

Cross Reference to Related Patents

The present invention is related to U.S. Patent 4,460,957 entitled "Self Pacing Serial Keyboard Interface for a Data Processing System" which is assigned to the assignee of the present invention. The teachings of this patent, which is sometimes referred to as the Keyboard Patent, are hereby specifically incorporated into this document by reference.

Suk *6/1*
10 The present invention is also related to two patent applications related to the selective locking of a keyboard. These patent applications, which are sometimes referred to as the ROM Scan Applications, are Serial No. 09/052,733 entitled "Personal Computer ROM Scan During Startup Protection" filed March 31, 1998 by

Sgt A

Robert Duane Johnson et al. and "Method and System for Improved Security During ROM Scan", Serial No. 09/431,728 filed on November 1, 1999, by Richard Alan Dayan et al. The ROM Scan Applications are assigned to the assignee of the present invention, with the disclosures of these patents specifically incorporated herein by reference.

5

Background of the Invention

Field of the Invention

The present invention is an improved system and method for providing security in a personal computer. More particularly, the present invention relates to securing an external bus (particularly the Universal Serial Bus, sometimes referred to as the USB Interface) and coupling the locked state of that bus with the locked state of the keyboard. This accomplishes security of the external bus consistent with the security of the keyboard.

Background Art

15 Personal computers in general, and the IBM personal computers in particular, have obtained wide spread use for a variety of data processing applications, providing computing power to many segments of society for handling information in the form of digital data. These personal computers may be defined

5

as desktop, floor-standing or a portable unit and typically include a system unit with a single system processor with volatile and nonvolatile memory, a display, one or more input devices such as a keyboard or a mouse connected to dedicated data ports in the system unit and one or more storage devices such as a floppy disk drive, a fixed disk drive or a CD ROM drive, and optionally, a printer or other output device. The components of a personal computer are assembled into an enclosure which includes a variety of data ports or external connectors to couple input and output devices to the single system processor.

10
11
12
13
14
15

20

Such personal computers not only include the dedicated port(s) for connecting the keyboard or mouse, but a variety of general purpose buses have been established to interface a wide variety of peripheral devices through well-defined (in some cases, industry-standard or quasi-industry standard) interfaces. One such type of interface is the Universal Serial Bus interface (sometimes referred to as the USB interface), the parameters of which are set forth in a generally available document entitled "Universal Serial Bus Specification" Release 1.1 dated September 23, 1998 from USB.ORG which was prepared by representatives of four companies; Compaq, Intel, Microsoft and NEC. Buses which comply with this standard are referred to as the USB interface and have been included on several recent versions of personal computers from various different manufactures for attaching devices for plug-and-play of personal computers with such computer peripherals as telephones, modems, CD-ROM

drives, joysticks, tape and floppy drives, scanner and printers. Additionally, the USB Interface allows an alternate connection for input devices such as keyboards and mice, providing an alternate to the dedicated keyboard and mouse ports which many manufacturers provide.

5 The ROM Scan Patents disclose that it is sometimes desirable to prevent a user input at an input device such as a keyboard or a mouse, a feature which locks out the keyboard from making effective inputs during sensitive periods such as the initialization of the personal computer during its power-on-self test, POST, and ROM scan. The ROM Scan Patents also teach that the memory of the computer system may be vulnerable to user inputs during these times and that user inputs should be controlled. One such way to control the input is to lock out the keyboard for at least part of the time during which ROM scan is occurring, as taught by the ROM Scan Patents.

10 In addition, there are other security features which advantageously control the keyboard. When a user leaves his workstation, he can invoke a security feature which locks out the keyboard until a key is used to unlock the system. Some systems also provide security by locking the keyboard during certain time periods and others require the use of a supervisory key to unlock the keyboard for use. Locking of a keyboard may be selectively controlled (by either a physical key 15 or by password or other security control) and is well known in the trade as a

desirable feature of current models of personal computers.

However, no locks for the USB port of the personal computer are specified in the document referred to above -- the Universal Serial Bus is generally available whenever the personal computer is powered up. Thus, a keyboard attached through the dedicated keyboard port may be secured against entries, but a similar keyboard accomplishing the same function is not secured at all when attached through the USB port.

0
9
8
7
6
5
4
3
2
1
0

Summary of the Invention

The present invention overcomes the disadvantages and limitations of the prior art devices while providing security for the system against devices hooked into it through an external bus such as the USB interface.

The present invention has the advantage that a keyboard lock applied to the keyboard port in a computer system has the effect of locking out an input device attached to the USB Interface.

By synchronizing the locking and unlocking of a keyboard attached to the dedicated keyboard port of a computer system with a USB interface, the system is secure against input devices, whether the input the device is attached to the dedicated port or attached to a USB interface.

5

The present invention has the advantage that it is a simple, yet effective, way of providing security for the sensitive portions of computer storage during times when they are vulnerable to attack because the operating system is writing to those portions of memory, e.g., during the power-on-self-test. The present invention overcomes the disadvantage in the prior art that the computer could be locked against keyboard input through the keyboard port while remaining open to a keyboard entry through the USB interface where an input device such as a keyboard is one of the devices intended to be connected.

9
10
11
12
13
14
15

Other objects and advantages of the present invention will be apparent to those skilled in the relevant art in view of the following description of the preferred embodiment, taken together with the accompanying drawings and the appended claims.

Brief Description of the Drawings

Having thus described some of the objects and advantages of the present invention, other objects and advantages of this invention will be apparent through the discussion of the drawings of present invention of an improved computer security system and method in which:

Fig.1 is a pictorial view of a computer system environment useful for understanding the present invention;

Fig. 2 is a block diagram of the computer system of Fig. 1;
Fig. 3 is a block diagram of the Computer System with the Present invention included;

5 Fig. 4 is a logic diagram for a keyboard sensing unit as shown in Fig. 3.
Fig. 5 is a logic diagram for a Security unit as shown in Fig. 3.

Detailed Description of the Preferred Embodiment

In the following description of the preferred embodiment, the best implementation of practicing the invention presently known to the inventors will be described with some particularity. However, this description is intended as a broad, general teaching of the concepts of the present invention in a specific embodiment but is not intended to be limiting the present invention to that as shown in this embodiment, especially since those skilled in the relevant art will recognize many variations and changes to the specific structure and operation shown and described with respect to these figures. Some of those skilled in the relevant art will also recognize that some of the benefits of the present invention can be obtained by using only some of the features described in connection with the present invention without the corresponding use of other features.

20 Fig. 1 is a pictorial view of a computer system 10 useful in understanding the present invention. The computer system 10 includes a system unit 12 with two input devices, a keyboard 14 and a mouse 16, coupled to it. The couplings are not

5

shown, but the system unit of many personal computers of recent vintage include dedicated ports for plugging in the keyboard and the mouse because such input devices are ubiquitous. Also shown as a part of the computer system 10 is a display 17, an optional printer 18 and a USB peripheral device 20. Many system units of current model personal computers include interfaces (or plugs) brought out to the outside of the case for specific devices (such as the display 17) and also a variety of general purpose ports into which peripheral devices can be attached, including at least one Universal Serial Bus (USB) interfaces (many personal computers from IBM currently provide two USB ports for attaching peripherals operating using the USB standards references above). The USB peripheral device 20 is plugged into one USB port of the system unit 12 which connects the USB peripheral to a system bus inside the system unit 12.

10
15

As described elsewhere in this document in greater detail, the USB interface was designed to accommodate an input or output device selected from a wide variety of potential input/output devices, such as a CD-ROM drive or a keyboard.

20

The ROM Scan Patents describe the risks associated with the use of a keyboard during initial start up of a personal computer, when the computer goes through power-on-self-test (POST) and performs a ROM scan looking for ROM adapters. The ROM Scan Patents describe the risks as potential data security risks and propose that the keyboard be locked out during that time (unless a user input is required by the ROM adapter). It is proposed in the ROM Scan Patents that

5

the dedicated interface to the keyboard and the mouse be selectively locked out from accepting user inputs during the period of time that the ROM scan is occurring in the computer. The present invention extends the protection (e.g., during the ROM scan activity) against keyboard input from a user to protect the computer system against user input transmitted through a general purpose interface such as the USB port by an input device connected to the USB port. In this way, the computer system is secured against user input during crucial time periods from either an input device connected either through a dedicated port for such an input device or through a general purpose port such as the USB interface. The concepts of the present invention relating to coupling the locking of the keyboard to a locking out of the general purpose port apply as well to times during the operation of the computer system other than the computer start up (e.g., POST and ROM scan) activity when the computer system may be locked against keyboard entries, such as to protect an unattended computer system.

10
15

Sub A2

Figure 2 is a schematic diagram of a portion of the personal computer 10. The keyboard 14 is coupled through a keyboard/mouse controller 22 via a Low Pin Count (LPC) or ISA bus 24 to the I/O Controller Hub (ICH) 28 via a Hub Link Bus (HLB) to a Memory Controller Hub (MCH) 27 via a Front Side Bus (FSB) to the central processor 26 of the personal computer 10.

20

Access by the central processor 10 is via the processors I/O address space

*Sub
a*

at I/O address space addresses 60 hexadecimal and 64 hexadecimal. The mouse 16 is also coupled to the keyboard/mouse controller 22. Both the keyboard 14 and mouse 16 ports are referred to as the PS/2 Keyboard and PS/2 Mouse ports, respectively in the PC industry. As known in the state of the art, any device that emulates either a keyboard or mouse can attach to the respective port.

5 In many personal computers, the keyboard 14 and mouse 16 ports are dedicated to their respective devices and are only configured to allow the attachment of such a device.

10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140
145
150
155
160
165
170
175
180
185
190
195
200
205
210
215
220
225
230
235
240
245
250
255
260
265
270
275
280
285
290
295
300
305
310
315
320
325
330
335
340
345
350
355
360
365
370
375
380
385
390
395
400
405
410
415
420
425
430
435
440
445
450
455
460
465
470
475
480
485
490
495
500
505
510
515
520
525
530
535
540
545
550
555
560
565
570
575
580
585
590
595
600
605
610
615
620
625
630
635
640
645
650
655
660
665
670
675
680
685
690
695
700
705
710
715
720
725
730
735
740
745
750
755
760
765
770
775
780
785
790
795
800
805
810
815
820
825
830
835
840
845
850
855
860
865
870
875
880
885
890
895
900
905
910
915
920
925
930
935
940
945
950
955
960
965
970
975
980
985
990
995
1000
1005
1010
1015
1020
1025
1030
1035
1040
1045
1050
1055
1060
1065
1070
1075
1080
1085
1090
1095
1100
1105
1110
1115
1120
1125
1130
1135
1140
1145
1150
1155
1160
1165
1170
1175
1180
1185
1190
1195
1200
1205
1210
1215
1220
1225
1230
1235
1240
1245
1250
1255
1260
1265
1270
1275
1280
1285
1290
1295
1300
1305
1310
1315
1320
1325
1330
1335
1340
1345
1350
1355
1360
1365
1370
1375
1380
1385
1390
1395
1400
1405
1410
1415
1420
1425
1430
1435
1440
1445
1450
1455
1460
1465
1470
1475
1480
1485
1490
1495
1500
1505
1510
1515
1520
1525
1530
1535
1540
1545
1550
1555
1560
1565
1570
1575
1580
1585
1590
1595
1600
1605
1610
1615
1620
1625
1630
1635
1640
1645
1650
1655
1660
1665
1670
1675
1680
1685
1690
1695
1700
1705
1710
1715
1720
1725
1730
1735
1740
1745
1750
1755
1760
1765
1770
1775
1780
1785
1790
1795
1800
1805
1810
1815
1820
1825
1830
1835
1840
1845
1850
1855
1860
1865
1870
1875
1880
1885
1890
1895
1900
1905
1910
1915
1920
1925
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
2080
2085
2090
2095
2100
2105
2110
2115
2120
2125
2130
2135
2140
2145
2150
2155
2160
2165
2170
2175
2180
2185
2190
2195
2200
2205
2210
2215
2220
2225
2230
2235
2240
2245
2250
2255
2260
2265
2270
2275
2280
2285
2290
2295
2300
2305
2310
2315
2320
2325
2330
2335
2340
2345
2350
2355
2360
2365
2370
2375
2380
2385
2390
2395
2400
2405
2410
2415
2420
2425
2430
2435
2440
2445
2450
2455
2460
2465
2470
2475
2480
2485
2490
2495
2500
2505
2510
2515
2520
2525
2530
2535
2540
2545
2550
2555
2560
2565
2570
2575
2580
2585
2590
2595
2600
2605
2610
2615
2620
2625
2630
2635
2640
2645
2650
2655
2660
2665
2670
2675
2680
2685
2690
2695
2700
2705
2710
2715
2720
2725
2730
2735
2740
2745
2750
2755
2760
2765
2770
2775
2780
2785
2790
2795
2800
2805
2810
2815
2820
2825
2830
2835
2840
2845
2850
2855
2860
2865
2870
2875
2880
2885
2890
2895
2900
2905
2910
2915
2920
2925
2930
2935
2940
2945
2950
2955
2960
2965
2970
2975
2980
2985
2990
2995
3000
3005
3010
3015
3020
3025
3030
3035
3040
3045
3050
3055
3060
3065
3070
3075
3080
3085
3090
3095
3100
3105
3110
3115
3120
3125
3130
3135
3140
3145
3150
3155
3160
3165
3170
3175
3180
3185
3190
3195
3200
3205
3210
3215
3220
3225
3230
3235
3240
3245
3250
3255
3260
3265
3270
3275
3280
3285
3290
3295
3300
3305
3310
3315
3320
3325
3330
3335
3340
3345
3350
3355
3360
3365
3370
3375
3380
3385
3390
3395
3400
3405
3410
3415
3420
3425
3430
3435
3440
3445
3450
3455
3460
3465
3470
3475
3480
3485
3490
3495
3500
3505
3510
3515
3520
3525
3530
3535
3540
3545
3550
3555
3560
3565
3570
3575
3580
3585
3590
3595
3600
3605
3610
3615
3620
3625
3630
3635
3640
3645
3650
3655
3660
3665
3670
3675
3680
3685
3690
3695
3700
3705
3710
3715
3720
3725
3730
3735
3740
3745
3750
3755
3760
3765
3770
3775
3780
3785
3790
3795
3800
3805
3810
3815
3820
3825
3830
3835
3840
3845
3850
3855
3860
3865
3870
3875
3880
3885
3890
3895
3900
3905
3910
3915
3920
3925
3930
3935
3940
3945
3950
3955
3960
3965
3970
3975
3980
3985
3990
3995
4000
4005
4010
4015
4020
4025
4030
4035
4040
4045
4050
4055
4060
4065
4070
4075
4080
4085
4090
4095
4100
4105
4110
4115
4120
4125
4130
4135
4140
4145
4150
4155
4160
4165
4170
4175
4180
4185
4190
4195
4200
4205
4210
4215
4220
4225
4230
4235
4240
4245
4250
4255
4260
4265
4270
4275
4280
4285
4290
4295
4300
4305
4310
4315
4320
4325
4330
4335
4340
4345
4350
4355
4360
4365
4370
4375
4380
4385
4390
4395
4400
4405
4410
4415
4420
4425
4430
4435
4440
4445
4450
4455
4460
4465
4470
4475
4480
4485
4490
4495
4500
4505
4510
4515
4520
4525
4530
4535
4540
4545
4550
4555
4560
4565
4570
4575
4580
4585
4590
4595
4600
4605
4610
4615
4620
4625
4630
4635
4640
4645
4650
4655
4660
4665
4670
4675
4680
4685
4690
4695
4700
4705
4710
4715
4720
4725
4730
4735
4740
4745
4750
4755
4760
4765
4770
4775
4780
4785
4790
4795
4800
4805
4810
4815
4820
4825
4830
4835
4840
4845
4850
4855
4860
4865
4870
4875
4880
4885
4890
4895
4900
4905
4910
4915
4920
4925
4930
4935
4940
4945
4950
4955
4960
4965
4970
4975
4980
4985
4990
4995
5000
5005
5010
5015
5020
5025
5030
5035
5040
5045
5050
5055
5060
5065
5070
5075
5080
5085
5090
5095
5100
5105
5110
5115
5120
5125
5130
5135
5140
5145
5150
5155
5160
5165
5170
5175
5180
5185
5190
5195
5200
5205
5210
5215
5220
5225
5230
5235
5240
5245
5250
5255
5260
5265
5270
5275
5280
5285
5290
5295
5300
5305
5310
5315
5320
5325
5330
5335
5340
5345
5350
5355
5360
5365
5370
5375
5380
5385
5390
5395
5400
5405
5410
5415
5420
5425
5430
5435
5440
5445
5450
5455
5460
5465
5470
5475
5480
5485
5490
5495
5500
5505
5510
5515
5520
5525
5530
5535
5540
5545
5550
5555
5560
5565
5570
5575
5580
5585
5590
5595
5600
5605
5610
5615
5620
5625
5630
5635
5640
5645
5650
5655
5660
5665
5670
5675
5680
5685
5690
5695
5700
5705
5710
5715
5720
5725
5730
5735
5740
5745
5750
5755
5760
5765
5770
5775
5780
5785
5790
5795
5800
5805
5810
5815
5820
5825
5830
5835
5840
5845
5850
5855
5860
5865
5870
5875
5880
5885
5890
5895
5900
5905
5910
5915
5920
5925
5930
5935
5940
5945
5950
5955
5960
5965
5970
5975
5980
5985
5990
5995
6000
6005
6010
6015
6020
6025
6030
6035
6040
6045
6050
6055
6060
6065
6070
6075
6080
6085
6090
6095
6100
6105
6110
6115
6120
6125
6130
6135
6140
6145
6150
6155
6160
6165
6170
6175
6180
6185
6190
6195
6200
6205
6210
6215
6220
6225
6230
6235
6240
6245
6250
6255
6260
6265
6270
6275
6280
6285
6290
6295
6300
6305
6310
6315
6320
6325
6330
6335
6340
6345
6350
6355
6360
6365
6370
6375
6380
6385
6390
6395
6400
6405
6410
6415
6420
6425
6430
6435
6440
6445
6450
6455
6460
6465
6470
6475
6480
6485
6490
6495
6500
6505
6510
6515
6520
6525
6530
6535
6540
6545
6550
6555
6560
6565
6570
6575
6580
6585
6590
6595
6600
6605
6610
6615
6620
6625
6630
6635
6640
6645
6650
6655
6660
6665
6670
6675
6680
6685
6690
6695
6700
6705
6710
6715
6720
6725
6730
6735
6740
6745
6750
6755
6760
6765
6770
6775
6780
6785
6790
6795
6800
6805
6810
6815
6820
6825
6830
6835
6840
6845
6850
6855
6860
6865
6870
6875
6880
6885
6890
6895
6900
6905
6910
6915
6920
6925
6930
6935
6940
6945
6950
6955
6960
6965
6970
6975
6980
6985
6990
6995
7000
7005
7010
7015
7020
7025
7030
7035
7040
7045
7050
7055
7060
7065
7070
7075
7080
7085
7090
7095
7100
7105
7110
7115
7120
7125
7130
7135
7140
7145
7150
7155
7160
7165
7170
7175
7180
7185
7190
7195
7200
7205
7210
7215
7220
7225
7230
7235
7240
7245
7250
7255
7260
7265
7270
7275
7280
7285
7290
7295
7300
7305
7310
7315
7320
7325
7330
7335
7340
7345
7350
7355
7360
7365
7370
7375
7380
7385
7390
7395
7400
7405
7410
7415
7420
7425
7430
7435
7440
7445
7450
7455
7460
7465
7470
7475
7480
7485
7490
7495
7500
7505
7510
7515
7520
7525
7530
7535
7540
7545
7550
7555
7560
7565
7570
7575
7580
7585
7590
7595
7600
7605
7610
7615
7620
7625
7630
7635
7640
7645
7650
7655
7660
7665
7670
7675
7680
7685
7690
7695
7700
7705
7710
7715
7720
7725
7730
7735
7740
7745
7750
7755
7760
7765
7770
7775
7780
7785
7790
7795
7800
7805
7810
7815
7820
7825
7830
7835
7840
7845
7850
7855
7860
7865
7870
7875
7880
7885
7890
7895
7900
7905
7910
7915
7920
7925
7930
7935
7940
7945
7950
7955
7960
7965
7970
7975
7980
7985
7990
7995
8000
8005
8010
8015
8020
8025
8030
8035
8040
8045
8050
8055
8060
8065
8070
8075
8080
8085
8090
8095
8100
8105
8110
8115
8120
8125
8130
8135
8140
8145
8150
8155
8160
8165
8170
8175
8180
8185
8190
8195
8200
8205
8210
8215
8220
8225
8230
8235
8240
8245
8250
8255
8260
8265
8270
8275
8280
8285
8290
8295
8300
8305
8310
8315
8320
8325
8330
8335
8340
8345
8350
8355
8360
8365
8370
8375
8380
8385
8390
8395
8400
8405
8410
8415
8420
8425
8430
8435
8440
8445
8450
8455
8460
8465
8470
8475
8480
8485
8490
8495
8500
8505
8510
8515
8520
8525
8530
8535
8540
8545
8550
8555
8560
8565
8570
8575
8580
8585
8590
8595
8600
8605
8610
8615
8620
8625
8630
8635
8640
8645
8650
8655
8660
8665
8670
8675
8680
8685
8690
8695
8700
8705
8710
8715
8720
8725
8730
8735
8740
8745
8750
8755
8760
8765
8770
8775
8780
8785
8790
8795
8800
8805
8810
8815
8820
8825
8830
8835
8840
8845
8850
8855
8860
8865
8870
8875
8880
8885
8890
8895
8900
8905
8910
8915
8920
8925
8930
8935
8940
8945
8950
8955
8960
8965
8970
8975
8980
8985
8990
8995
9000
9005
9010
9015
9020
9025
9030
9035
9040
9045
9050
9055
9060
9065
9070
9075
9080
9085
9090
9095
9100
9105
9110
9115
9120
9125
9130
9135
9140
9145
9150
9155
9160
9165
9170
9175
9180
9185
9190
9195
9200
9205
9210
9215
9220
9225
9230
9235
9240
9245
9250
9255
9260
9265
9270
9275
9280
9285
9290
9295
9300
9305
9310
9315
9320
9325
9330
9335
9340
9345
9350
9355
9360
9365
9370
9375
9380
9385
9390
9395
9400
9405
9410
9415
9420
9425
9430
9435
9440
9445
9450
9455
9460
9465
9470
9475
9480
9485

*Suit
a2*

5

locked, the switch prevents data from reaching the USB host controller 30 and the microprocessor 24, however, the USB Keyboard sensing unit 84 can still monitor the transmissions from devices attached to the USB ports 88 to monitor for entry of the password in order to unlock the bus 88. As USB keyboard keystrokes are detected, the keyboard sensing unit unpacks the USB usage codes and converts them to the well known PS/2 keyboard scan codes via bus 90 to the security unit 90 for correct password entry verification. When unlocked, the switch allows all USB transmissions from devices attached to the USB ports 88 to the USB host controller 30 and the microprocessor 24. In this way, when the switch 80 is in the locked state and keyboard inputs are not being processed from the USB ports 88 by the microprocessor 26, there is still something in the personal computer (the security unit 82) listening for a correct password to unlock the system and allow direct communication from either the keyboard 14 and/or a USB keyboard attached to one of the USB ports 88.

10
15

Figure 4 shows the logic in use in the USB Keyboard Sensing Unit 84 of this invention. The Sensing unit 84 constantly monitors 60 the USB bus 88 for the presence of data and commands.

20

If data is found, it is checked to see if it is a Control Request 62. If not a control request, the data is checked to see if a USB device is sending data to the controller 70. If it is not a data packet, the sensing unit 84 returns to monitor the

*Sil
a2*

5

USB bus 60. If a USB data packet is present 70, the sensing unit 84 checks to see if it is from a keyboard device identified 72 in step 68. If not a keyboard data packet, the sensing unit 84 returns to monitor the USB bus 60. If it is keyboard data packet 72, the sensing unit detects the usage code from the data packet 74 and converts the usage code to the industry standard scan code used by the PS/2 Keyboard device 76. The sensing unit 84 then transmits the scan code to the Security Unit 82 for processing and returns to step 60 to monitor the USB bus 88 for more data packets.

0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

Returning to step 62, if the data is a control request, the sensing unit tests to see if it is a USB Keyboard Descriptor 64. If not, the sensing unit returns to its monitoring state in step 60. If the data is a keyboard descriptor 64, the sensing unit looks for an ID command 66. When found, the USB ID is stored so that the USB device is recognized as a USB keyboard. Then processing returns to step 60 where the monitoring process resumes.

15
20

Figure 5 illustrates a logic design for the security unit 82 to allow it to recognize a correct password to unlock the keyboard attached to the system when the personal computer (and its processor 26) is otherwise locked against user inputs. The security unit 82 receives, at block 100, a single unit of data, such as would emanate from a single key stroke on a PS/2 personal computer keyboard or a USB keyboard attached at USB interface 88, indicating either a single character

*Sut
Q2*

5

or a command from the processor 26 to the keyboard and checked to see if this data is a Load Password Command from the processor. If it is a Load Password Command, the security unit 82 intercepts and stores the next set of characters as the password until a terminator (00h) is encountered 102. Processing continues at step 100 again.

8
9
10
11
12
13
14
15

20

Returning to step 100, if the data is not a Load Password Command, the security unit 82 checks to see if the data is an Enable Password Command 104 from the processor 26. If not, the security returns to step 100 to monitor the USB bus 88 and PS/2 I/O ports 60h and 64h 86. If the data is an Enable Password command, the security unit 82 checks to see if a valid password is already loaded 106. If not, the security unit returns to step 100 to continue monitoring. If a valid password is already loaded, the security unit 82 locks the switch 80 in step 108. Following locking the keyboard, the security unit 82 goes into a monitoring state to check for the entry of a Valid password 110. The password may be entered on either the PS/2 Keyboard 14 or a USB keyboard attached at the USB interface 88. The system remains locked with respect to keyboard entry until the password is correctly entered. In step 112, the security unit 82 checks to see if the password was entered. If not entered correctly, the security unit 82 go to step 110 to monitor for entry of a password once again. If entered correctly, the switch 80 is unlocked 114 and the security unit 82 start the process over again at step 100.

5

Of course, many modifications of the present invention will be apparent to those skilled in the relevant art in view of the foregoing description of the preferred embodiment, taken together with the accompanying drawings. The system for locking and unlocking the interface port to the keyboard port can be changed to fit the system requirements and designer's preferences, for example, by using a single interface through which the dedicated input device ports and the general purpose interfaces passes, then enabling or disabling the single interface, as desired, to prevent used input through either the dedicated port or the general purpose port. The system for locking the inputs is subject to various other approaches, including other software, hardware and combination approaches to accomplish the functions desired in a known manner. Thus, many modifications to the system described above can be made without departing from the spirit of the present invention. Accordingly, the foregoing description of the preferred embodiment should be considered as merely illustrative of the principles of the present invention and not in limitation thereof.

10
11
12
13
14
15
16
17
18
19
20